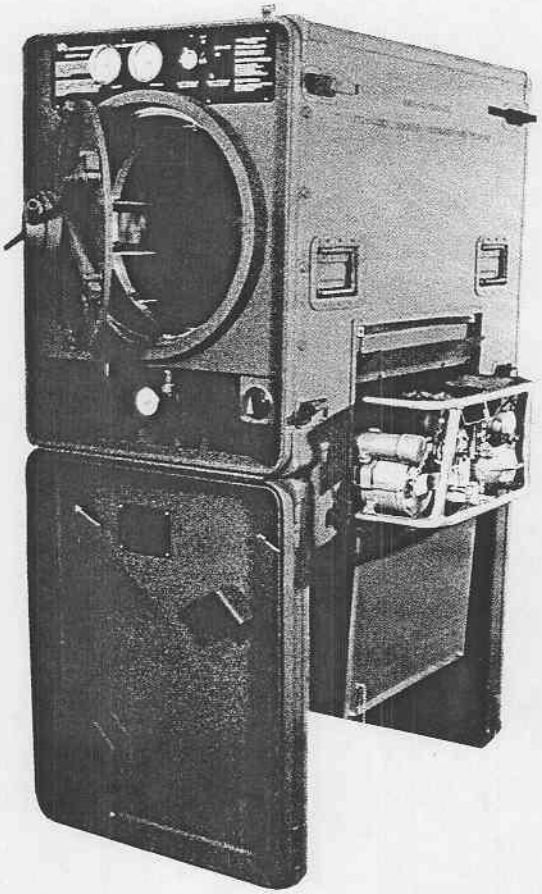
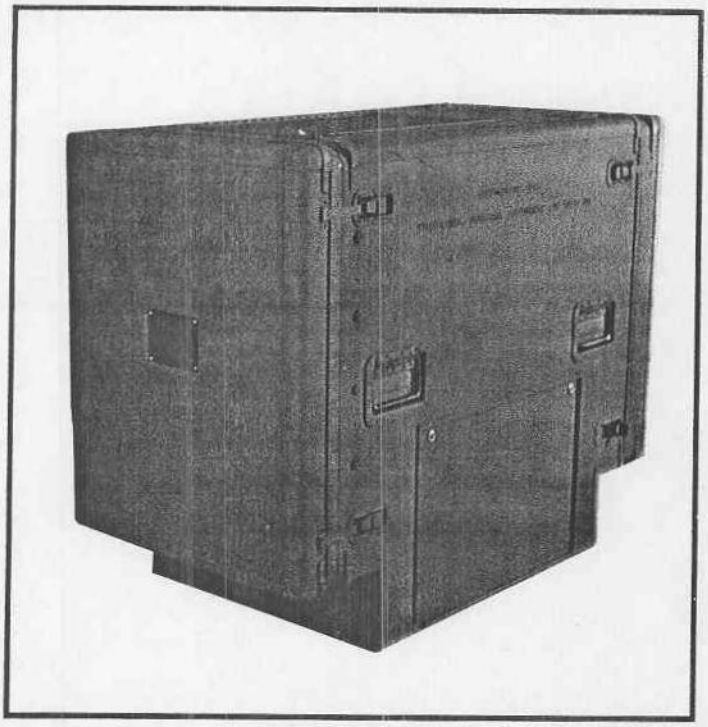
M-138
Portable Field Hospital Sterilization System



Rugged Portable Sterilization Systems Designed To Meet Stringent U.S. Government Specifications

ENVIRONMENTAL TECTONICS CORPORATION



Designed For: Mobile surgical hospitals, remote locations, and most other field-emergency conditions.

Multiple Applications: The M-138 steam sterilizes and dries wrapped and unwrapped dressings, instruments, utensils, glassware, gloves, syringes, bed pans, discharge kits, and liquids.

Specifications: Meets stringent U.S. Government military specifications.

Construction: Cylindrical chamber — 406 mm I.D. x 914 mm L (16"x 36"), is of heavy duty aluminum, double-shelled construction welded at the seam, and will withstand operating pressure of 2.3 bar (33 psig). The inner and outer shells are placed one within the other, evenly staged and reinforced to form a jacket over the entire exterior of the inner shell. All pipes and fittings are nonferrous metal. Door is aluminum plate with low heat conducting handles. Seven aluminum shelves, with the top six installed in any combination, provide flexibility.

Rugged Housing: For protection, the M-138 is built with a rugged case. When completely closed, the case protects the sterilizer and the heat source, and also serves as a shipping container. When opened, it becomes a suitable stand.

Portable: Specially shaped for easy handling and shipping. Weight does not exceed 142 kg (312 lbs), including weight of heat source.

Simple Operation: Each phase of the sterilizing cycle — pressurization, exhaust, and vacuum — is started manually by a programming wheel operating a single multi-port valve. The programming wheel has a cycle-phase indicator.

Instrumentation: Temperature and pressure gauges are located in easy to read positions. The timer is located beneath the door frame.

Accuracy: Pressure gauges within 0.1 bar (1.5 psig), timer within 5 seconds, thermometer within 0.5°C between 98.9°C to 132.2°C (210°F to 270°F).

Simplified Design: Provides greater reliability, fewer repairs, and easy access to components.

No Inventory Build-up: Sterilizer uses quick-dry and gas-exhaust cycles, preventing inventory build-up at peak demand periods.

Steam Supply: For field operation, power steam can be supplied from multiple sources. Electricity, gasoline, or external steam can all be utilized.

Safety: The low water safety switch will cut the flow of electric power to the heaters should water in the steam enclosure fall to an unsafe level. Door radial-holding arms exert even pressure on the gasket, preventing steam leaks. The door seal is broken well before the radial arms have been disengaged from the head ring, allowing steam to escape from the chamber without endangering the operator.

M-Series Specifications:

Internal			External			
Model	Capacity lt (cu ft)	Chamber Dimensions mm (in)	Length mm (in)	Width mm (in)	Height mm (in)	Weight kg (lbs)
M-138	118 (4.19)	406 x 914 (16 dia x 36)	1168 (46)	635 (25)	1575 (62) Door Open	142 (312)

For more information: County Line Industrial Park Southampton, PA 18966-3877 USA
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INSTRUCTIONS

FOR

STERILIZER, SURGICAL INSTRUMENT AND DRESSING, PRESSURE, STEAM, ELECTRIC OR GASOLINE BURNER HEATED, CORROSION-RESISTING METAL, 16X36 INCHES, 208-220-380-440 VOLT 50/60 CYCLE, AC.

MODEL NO. M 138

NSN 6530-00-926-2151

CONTRACT NO. DLA120-84-C-5251

ETC® STERILIZERS

ENVIRONMENTAL TECTONICS CORPORATION
County Line Industrial Park, Southampton, PA 18966, U.S.A.

SEPTEMBER, 1985

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INTRODUCTION

The sterilizer is of fully jacketed, horizontal pressure type construction, and is designed as a portable unit for use under field emergency conditions. It is suitable for the sterilizing and drying of surgical instruments, utensils, dressings, and flasked surgical solutions.

The sterilizing unit is of welded aluminum alloy construction for light weight. The chamber assembly, with internal dimensions of 16" diameter x 36" long, is supported in a combination case at the backhead and end ring to provide rigidity and protection. This case, when closed, completely encloses and protects the sterilizer and its heat source, serves as a shipping container, and when opened, provides an integral stand placing the sterilizing chamber and operating controls at a convenient working height. When closed, ready for shipment, the case is designed to withstand rough handling and to stack and handle easily.

Universal shelves are supplied to provide four shelf levels, the top three in any combination to provide flexibility. The shelves are removable and stack for compact storage. A jacket cleanout opening is provided at the rear of the sterilizer to remove foreign accumulations in the jacket. A scraper to facilitate this is supplied.

The sterilizer is designed to utilize the jacket as a steam boiler. Steam can be produced by electric immersion heaters, or by use of a gasoline burner unit. The unit can also be connected directly to a steam supply line by addition of a direct steam conversion unit.

Water is retained in the jacket of the sterilizer, and when it is heated, the hot gases are directed around the shell and out vent pipes at the top of the unit. A water level indicator is located at the rear of the sterilizer, the sight glass being resilient mounted to prevent breakage. Steam is taken from the top front of the jacket and introduced into the chamber at the top rear. A baffle deflects the steam through the chamber, and exhaust air leaves at the front bottom of the chamber through a removable, screened outlet. A low water cut-off is provided for protection of the electric heating elements.

The sterilizer is equipped with a single control multiport valve and vacuum drying system. With this arrangement, a single control valve directs the steam flow and exhaust by means of successive positions of the control knob. Provision is made for fast or slow exhaust and vacuum drying. During the vacuum drying, a slight vacuum is created in the chamber, and clean, filtered air is then introduced into the chamber and ejected to atmosphere. By means of this system, drying of the load is accomplished with the chamber door closed, minimizing the danger of contamination by outside air currents.

Chapter I

TABLE OF LEADING PARTICULARS

Overall Length (With Doors Closed)	46"
Width	24-1/4"
Height (Doors Closed)	37-3/16"
Height (Doors Open)	62"
Weight (Basic Unit Including Electric Heat)	255 Lbs.
Add for:	
Gasoline Burner Unit (Dry)	44 Lbs.
Direct Steam Conversion Unit	13 Lbs.

Power Requirements	ACTUAL LOAD	RECOMMENDED LINE FUSE
220 Volts-AC-50 or 60 Cycles Single Phase	45 Amperes	50 Amperes
or		
380 Volts-AC-50 or 60 Cycles Three Phase	15 Amperes	20 Amperes
or		
220 Volts-AC-50 or 60 Cycles Three Phase	25 Amperes	30 Amperes
or		
*208 Volts-AC-50 or 60 Cycles Three Phase	25 Amperes	30 Amperes
or		
**440 Volts-AC-50 or 60 Cycles Three Phase	15 Amperes	20 Amperes
or		
**440 Volts-AC-50 to 60 Cycles Single Phase	15 Amperes	20 Amperes

*On 208 Volt Power unit does not operate at rated wattage - will require longer heat-up time.

**On 440 Volt Power unit operates on 2/3 rated wattage with only 2 heaters energized - will require longer heat-up time.

Note: Power supply should be fused accordingly and frame of sterilizer should be adequately grounded.

Gasoline Burner Unit - U.S. National Stock No. 7310-00-842-9247

Sterilizing Range - 250°F and 270°F

Chapter II

INSTALLATION

A) GENERAL

Since the unit is self-contained, very little installation is required. To set up the sterilizer for operation, first open either side door and remove the gasoline burner. Tilt the unit lengthwise so that the front end is raised up. Unlatch the door in the front end and swing down 180° into place. The two "T" bars on the door should be screwed firmly into the case to anchor the door to the case. Unlatch the door on the rear of the unit and raise up the back end of the unit allowing the door to drop into place. Tighten the two thumbscrews into the case. If necessary, the sterilizer should be blocked up so that it is steady and level. To insure that the unit is properly leveled, open the sterilizer door and pour a small quantity of water on the bottom of the chamber at the rear. The water should gently flow to the chamber drain in front of chamber. Adjust blocking as required to insure proper drainage of condensate. Shelves should be arranged as desired. Check the chamber and jacket drain openings on bottom of case for any obstructions to the free flow of water.

WARNING: End must be fully opened to leg position and securely fastened in place before unit is operated!

For indoor use, a funnel should be mounted under the chamber drain and suitably piped to a waste line. The vent line may be rotated to point in a convenient direction by loosening the fitting attaching it to the multiport valve, turning the tube to desired position and then retightening the fitting. A hose may be attached to the 1/2" O.D. tube vent to pipe the exhaust to the outside to prevent excessive humidification of the room air or to prevent damage to tenting.

The desired heating unit should be installed according to the following instructions.

B) ELECTRIC HEAT

To operate on electric heat, the unit need only be connected to the power supply. Access to the terminal strip is by removal of cover on the electric control box. This unit has been designed to operate on various power supplies. Following is a list of these power supplies, together with the appropriate wiring diagram.

220 Volts - Single Phase - 50 or 60 Cycle - 45 Amps - Wiring Diagram A
380 Volts - Three Phase - 50 or 60 Cycle - 15 Amps - Wiring Diagram B
220 Volts - Three Phase - 50 or 60 Cycle - 25 Amps - Wiring Diagram C
208 Volts - Three Phase - 50 or 60 Cycle - 25 Amps - Wiring Diagram D
440 Volts - Three Phase - 50 or 60 Cycle - 15 Amps - Wiring Diagram E
440 Volts - Single Phase - 50 or 60 Cycle - 15 Amps - Wiring Diagram F

Note that in addition to connecting the power supply correctly to the terminal strip, it may be required to change a connection between the heaters as noted on the appropriate wiring diagram. Also, for 440 volt power, the connection on the contactor coil must be changed to the 440 volt terminal. For operation on 440 volt, single or 3 phase power, only two heaters will be energized, with the unit operating on 2/3 wattage, thus increasing the heat-up time. If 440 volt, 3 phase power is used, the heaters are connected across a single phase creating an unbalanced load. If

operated on 208 volt power, heat-up time will be longer due to reduced wattage.

CAUTION: Ensure that the frame of the sterilizer is adequately grounded before operating on electric power.

C) GASOLINE BURNER UNIT

A cavity has been provided to accept the gasoline burner unit used with the U.S. Army field range. The gasoline burner unit is known by National Stock Number NSN 7310-00-842-9247. The burner unit will burn any gasoline, leaded or not. A pump is needed for creating air pressure in the tanks. The burner unit should be checked for leaks under air pressure prior to filling with gasoline.

A door is provided on both sides of the sterilizer fire box, permitting the burner unit to be inserted from either side. These doors are provided with a chain to hold them partially closed, if required, to shield the burner from a strong wind. These doors should not be completely closed when gasoline burner is used, but left open at least several inches. The door in the top of the unit must be open to permit venting of hot gases from the burner.

When this source of heat is used, with the unit in confined space, it is suggested that two 4" stovepipe flues be fitted to the top vent of the sterilizer. Each flue should be run independently to the outside.

D) DIRECT STEAM CONVERSION UNIT

Remove the pipe plug from the right hand side of the heater flange. Connect the pressure regulator and supply valve assembly to this opening. Connect the trap assembly to the opening from the drain valve. Connect external steam supply at 50 to 80 psi to steam supply valve.

NOTE: With this conversion unit installed, the sterilizer may be operated with either electric heat or gasoline burner by closing the "steam supply unit" valve and the "drain valve".

Chapter III

OPERATING INSTRUCTIONS

A) FILLING WITH WATER

If the sterilizer is operated on electric power or gasoline heat, the jacket must be filled with water as pure as possible. Check the jacket at every cycle. A new cycle should not be started if the jacket is less than 1/4 full. If the sterilizer is allowed to run dry, the low water cut-off will trip out, thus interrupting the cycle.

If distilled water is used, it results in less frequent cleaning of the jacket interior.

CAUTION: Lift the "relieve handle" of the safety valve or turn operating valve to "dry" position to release any pressure in the jacket before removing the plug from the filling funnel.

1) Remove the plug from the filling funnel.
2) Turn the operating valve to the "sterilize" position.
3) Fill the jacket with water thru the funnel until the sight glass shows "full".
4) Turn the operating valve to "off".
5) Replace the plug in the funnel.

B) PRELIMINARY PROCEDURE (ELECTRIC HEAT)

CAUTION: Ensure that the frame of the sterilizer is adequately grounded before operating on electric power.

1) Ensure that the sight glass shows the water level in the jacket to be at least at the 1/4 mark.
2) Turn the "pressure control switch" knob to the maximum clockwise position.
3) Ensure that the operating valve is in "off" position.
4) Turn the heat switch on. The heaters are energized and the red pilot light will glow.
5) When the jacket pressure gauge shows the desired pressure (for 250°F operation: 18 psig, and for 270°F operation: 29 psig), turn the "pressure control switch" knob slowly counterclockwise until the pilot light goes out. The "pressure control" will then cycle automatically, maintaining the selected pressure. A preheating time of 10 to 15 minutes is recommended to allow the pressure to stabilize.

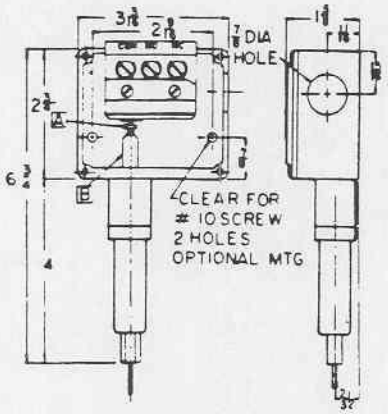
NOTE: There are no markings or calibration on the pressure control switch since temperature is a function of absolute pressure rather than gauge pressure. Depending on altitude and atmospheric conditions, to obtain 250°F temperature may require anywhere between 15 and 20 psi gauge pressure and to obtain 270°F temperature may require between 27 and 32 psi gauge pressure. Therefore, the pressure switch must be adjusted to the pressure which will give the desired temperature and the setting

will vary according to atmospheric conditions and altitude.

6) The sterilizer is now ready for loading.

NOTE: In the event that water in the jacket runs low, the low water cut-off will interrupt the power supply to heaters. If this occurs, lift the "relieve handle" on the safety valve to release any pressure in the jacket before removing the plug from the filling funnel. Wait until internal parts cool below the boiling point and refill the jacket with water. Then press the reset button (located underneath the heater box). Then proceed with the regular operating cycle from the beginning.

LOW WATER CUT-OFF ADJUSTMENT



Due to severe field conditions, the low water cut-off switch may require adjustment. This is accomplished by holding plunger B stationary. Turn hexagonal adjustment screw A clockwise (in) to raise setting. Operate the sterilizer thru a 270°F cycle, and after it is about ten minutes into the cycle, turn the calibrating screw counter-clockwise until the switch trips. Then turn the screw clockwise about 1/8 turn and reset the switch. This setting may be checked by opening the drain valve and draining chamber while heating elements are turned on. The low water cut-off should actuate by the time the chamber is drained. Caution: The drain valve should be piped to an open container to prevent possibility of operator injury from the live steam.

NOTE: In the event that the jacket becomes loaded up with lime and other mineral deposits, the low water cut-off will continue to trip out during operation. When this occurs, follow maintenance instructions for cleaning jacket.

C) PRELIMINARY PROCEDURE (GASOLINE HEAT)

1) Ensure that the sight glass shows the water level in the jacket to be at least at the 1/4 mark.
2) Ensure that the operating valve is in the "off" position.
3) Service and ignite the gasoline burner unit as per operating instructions on the burner unit and insert it into the firebox of the sterilizer.
4) Both side doors on the burner cavity should be left open unless partial closing is required to shield the burner from the wind. A chain is provided to hold the door partially closed and provides a wide range of adjustment. The doors should never be completely closed when the gasoline burner is being used, but left open at least several inches. The door on the top of the unit must be open to permit venting of heat gases.
5) When the jacket pressure is as desired (for 250°F operation: 15 to

18 psig and for 270°F operation: 26 to 29 psig), reduce the flame by use of the burner controls to maintain the desired pressure. A preheating time of 10 to 15 minutes is recom- mended to allow the pressure to stabilize.

6) The sterilizer is now ready for loading.

NOTE: To prevent an overshoot of temperature when operating the sterilizer at 250°F, a pressure relief valve has been provided. This valve is located at the top rear of the unit and is controlled thru a hand valve. When sterilization at 250°F is desired, open the shut-off valve to the pressure relief valve. For operation at 270°F, this hand valve must be closed.

D) PRELIMINARY PROCEDURE (DIRECT STEAM HEAT)

1) Open drain valve.
2) Open steam supply valve.
3) Adjust pressure regulator to desired pressure. Turning handle clockwise increases pressure, counterclockwise decreases pressure. A preheating period of 10 to 15 minutes is recommended to stabilize pressure.

NOTE: Operation on direct steam heat requires the installation of the direct steam adapter kit.

E) OPERATION

1) Load the sterilizer leaving enough space between the packs to permit free circulation of steam. Too close packing of fabric loads will slow the cycle and may cause failure in sterilization.
2) Close the door and tighten handwheel securely. The handwheel will not operate until the door locking arms are properly located in the end rings. This is accomplished by rotating the "quick-throw" handle clockwise, item #19, Figure #5.
3) Turn the operating valve to the "sterilize" position.
4) The jacket pressure will fall as the chamber fills with steam and both jacket and chamber will then build up to the desired pressure. When the thermometer in the chamber drain line reads the desired temperature, the timing of the exposure period may commence.
5) At the end of the exposure period, turn the operating valve to:
"Fast Exhaust" for fabric or instrument loads.
"Slow Exhaust" for solution loads.

Leave the machine alone until the chamber pressure gauge shows zero pressure.

NOTE: Source of heat should be turned off when operating valve is turned to the "Slow Exhaust" position. Heat should remain on for "Fast Exhaust" or "Dry" cycle.

6) If drying cycle is required (as in fabric loads), turn the operating valve to "dry".
7) Turn the operating valve to "off". Loosen the door locking arms and allow the load to cool for five minutes. Open

the door and remove the load.

The sterilizer may be reloaded and recycled immediately. If sterilizer is not to be used again immediately, turn off the heat source and turn the operating valve handle to the "Dry" position. This will bleed off pressure and vent the jacket to prevent a vacuum forming. The sterilizer door should be closed, but not tightened to prevent vacuum forming in chamber.

Chapter IV

RECOMMENDED EXPOSURE PERIODS

FABRIC LOADS

30 Minutes at 250°F
Dry for 15 Minutes

SOLUTION LOADS

1000 ML Flasks:

30 Minutes at 250°F
Slow Exhaust to Zero Pressure
Crack Door for 5 Minutes

EMERGENCY

Small Instrument Load:

3 Minutes at 270°F
Fast Exhaust

When sterilizing solutions, use only thermal shock-resistant containers (Pyrex, Vicor, etc.) with self-venting closures. Do not leave door open or remove glass containers until the chamber drain thermometer indicates 200°F or lower.

Chapter V

MAINTENANCE

A) GENERAL

The chamber drain plug screen should be removed daily and lint and sediment removed from the strainer.

The interior surface of the shell should be cleaned daily before heating. Wash with a mild detergent in water. Do not use steel wool or any abrasive cleanser. The shelving may be cleaned in the same manner as the shell.

When sterilizing solutions, the shell interior should be washed down as soon as the sterilizer has cooled.

The interior surfaces of the case should be cleaned regularly and kept free of dust and moisture.

Periodically, it will be necessary to remove accumulated salts from the jacket interior. A scraper is provided for this purpose. The frequency with which this becomes necessary depends on the hardness of the water used. Too great an accumulation of salts will impair the heating efficiency and could cause the heating elements to burn out. An indication of the excessive accumulation of salts will be tripping of the low water cut-out while there is still water in the jacket. When this occurs, remove the heater box cover (Reference Figure #3), disconnect wiring from the heater terminals, remove 3/8 hex nuts on heater assembly and remove heaters from the jacket. After cleaning salts from the jacket and heating elements, replace and reconnect the heater assembly.

B) OPERATING VALVE (FIG. 4)

The only trouble that can be expected from the operating valve is leaking of the valve seat or of the stem packing. This rarely occurs, but may be remedied by replacing the defective parts.

Disassemble the valve by removing the five body screws. If the carbon seat is worn, it should be replaced. Use care not to damage the seating face of the casting.

When reassembling the valve, ensure that the leg on the stem fork labeled "O" is inserted in the stepped hole in the carbon disc. The side of the disc with the milled slot part way through is the seating face and should be against the face of the valve body. The valve is "off" when the stem key way is 45° to the left of the top of the valve as viewed from front of sterilizer.

C) DOOR (FIG. 5)

The door should be greased about twice annually when in service.

The stop should be removed from the door post end and the handwheel retaining ring removed. The handwheel may then be unscrewed, exposing the bearing and screw threads. Grease these parts liberally, with high temperature grease such as Lubriplate 930AA.

To disassemble the door, proceed as for greasing. Then remove the three door post screws on the inside of the door and knock out the door post. The hub may then be rotated until the arms are clear of the fulcrums and the entire assembly lifted off.

Assembly of the door is a reversal of the above. Take care that the hole in the hub flange lines up with the peg in the door to permit the door to be locked.

The "O" ring under the door post should be replaced when the door post is refitted. To replace the door gasket, simply lubricate it with soap and water. Lay the gasket in place and push it into the groove with the fingers of four equi-distant points. Then carefully work the gasket into the

groove until it is evenly distributed around the door. Working from one point will result in too much or too little gasket left over at the other side of the door.

The hinge pins should be greased when the door is greased, using Lubriplate 930AA. First, loosen the Allen screws in the hinge blocks, and drive the pins out with an aluminum or brass drift. Grease the pins and replace. Tighten the Allen screws.

D) CARRYING CASE

Periodically the hinges and latches on the case should be oiled with a few drops of light motor oil.

E) ELECTRIC IMMERSION HEATERS

If necessary to replace a defective heater, refer to Figure 2 - heater assembly - and proceed as follows after cutting off power supply to heaters.

Remove cover from the heater box and disconnect the wires from heaters. Remove the eight 3/8 nuts and washers from the studs and pull the heater plate from the jacket. The gasket should be removed and discarded. Unscrew the male connections holding heater to the plate and remove the defective heater.

Slide the connectors over end of replacement heater and screw into the heater plate. Use Parker Unipar or equivalent to seal all joints. Remove support Ref. #5 from old heater and position on the new one.

Slide the new gasket Ref. #2 over the heating elements against the plate and insert the heater assembly into the jacket cleanout opening. Place the electric box over the studs in the jacket cleanout flange and secure it with the eight nuts and washers on the studs and reconnect the wires to the heaters. Replace cover on box.

Chapter VI

PREPARATION FOR SHIPMENT OR STORAGE

The interior surface of the shell should be cleaned thoroughly by washing with a mild detergent - do not use an abrasive cleanser! All shelving and all exposed interior surfaces of the case should be cleaned in the same manner. The chamber drain plug should be cleaned and all lint and sediment removed from the strainer.

With the sterilizer door open, turn the operating valve to the "sterilize" position and open the jacket drain valve. Gently rock the sterilizer from side to side and from end to end to ensure removal of all water from the jacket, chamber and piping.

Turn the operating valve to the "dry" position and leave all valves open.

The sterilizer door should be closed and tightened only enough so that the handles clear the front door of the case when it is closed.

Remove all external piping and wiring.

Release fuel tank air pressure, remove burner assembly and drain the fuel from the fuel tank into a suitable container.

WARNING: Allow the unit to cool before draining the fuel tank. Do not smoke, and make sure there is no open flame in the vicinity.

Close the top door and both side (fire box) doors and latch in place.

Unscrew the two "T" bars holding the rear door to the case. Raise back of unit up to permit swinging the door up to the closed position and latch door into place. Release "T" bars on front door, swing up into closed position and latch into place.

Chapter VII

TROUBLESHOOTING CHART

FAULT	PROBABLE CAUSE	REMEDY
Pilot light does not light on electrical operation.	1. No power to unit.	1. Check power line and fuses.
	2. Defective power switch.	2. Replace power switch.
	3. Lamp burned out.	3. Replace lamp.
	4. Loose electrical connection.	4. Check wiring for loose connections or broken wire.
	5. Low water cut-out tripped.	5. Fill with water and reset.
No steam pressure. Electric operation.	1. Defective pressure control.	1. Repair or replace control.
	2. Contactor coil defective.	2. Replace contactor coil.
Steam pressure high, low, or erratic. Electric heat operation.	1. Pressure control sticking or defective.	1. Repair or replace pressure control.
	2. Pressure gauge error.	2. Calibrate or replace pressure gauge.
	3. Loose electrical connection.	3. Check wiring for broken wire or loose connection.
Excessive time to generate steam. Electric heat operation.	1. Low voltage.	1. Check and adjust.
	2. Defective heating element.	2. Replace heating element.
	3. Loose electrical connection to heaters.	3. Check wiring to heaters.
	4. Mineral deposits in jacket.	4. Clean jacket and heating elements.
Chamber does not come up to operating temperature or pressure.	1. Operating valve handle incorrectly positioned.	1. Turn handle to proper position.
	2. Steam trap stuck open.	2. Overhaul steam trap.
	3. Plugged screen in chamber drain.	3. Clean screen.
	4. Door leaks.	4. Tighten door or replace door gasket.
	5. Defective thermometer.	5. Replace thermometer.
	6. Pressure gauge error.	6. Calibrate or replace gauge.
	7. Pressure control or pressure regulator set too low.	7. Correct setting.

TROUBLESHOOTING CHART

FAULT	PROBABLE CAUSE	REMEDY
Low Water cut-out trips with water in jacket. (Electric Heat)	1. Mineral deposits in jacket. 2. Low water cut-off needs adjustment.	1. Clean jacket and heating elements. 2. Adjust low water cut-out.
Water in chamber.	1. Plugged screen in chamber drain. 2. Plugged drain line. 3. Steam trap does not open for water.	1. Remove screen and clean. 2. Clean drain line. 3. Overhaul steam trap.
Steam comes out vacuum dryer.	1. Vacuum dryer clogged and inoperative. 2. Vacuum dryer not in a vertical position.	1. Overhaul vacuum dryer. 2. Straighten vacuum dryer.
Load does not dry.	1. Vacuum dryer clogged. 2. Operating valve handle not properly positioned. 3. Heat source shut off during dry cycle. 4. Vacuum dry time insufficient. 5. Goods improperly loaded.	1. Overhaul vacuum dryer. 2. Turn to proper position. 3. Continue jacket pressure throughout cycle. 4. Time for full 15 minutes. 5. Arrange load so moisture will drain off.
Solution exhaust too fast or too slow.	1. Operating valve handle not positioned properly. 2. Multiport valve plugged or defective.	1. Turn to proper position. 2. Clean or repair multiport valve.
Safety valve "po[illegible] prematurely c[illegible] not release at set pressure.	1. Defective safety valve.	1. Replace safety valve.
Case overheats. Gasoline burner operation.	1. Insufficient venting. 2. Firebox door closed. 3. Wing baffle improperly positioned.	1. Check stack for obstruction and for proper draft. 2. Open door. 3. Position wing baffle properly.
No steam pressure. Direct steam operation.	1. Steam valve closed. 2. Faulty steam control valve. 3. No steam supply to unit.	1. Open supply valve. 2. Repair. 3. Supply steam to unit.

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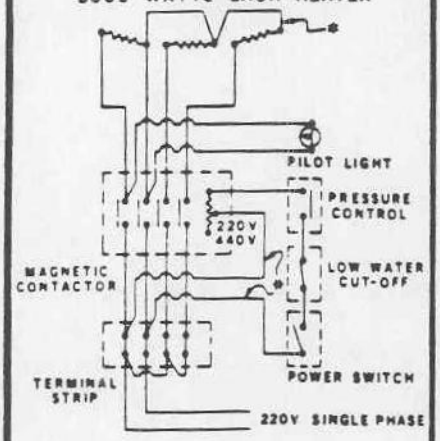
TROUBLESHOOTING CHART

FAULT	PROBABLE CAUSE	REMEDY
Steam pressure high, low or erratic. Direct steam operation.	1. Steam supply less than 35 psi minimum.	1. Increase steam supply pressure.
	2. Steam pressure regulator sticking or defective.	2. Repair or replace steam pressure regulator.
	3. Steam trap clogged or stuck open.	3. Overhaul steam trap.
	4. Pressure gauge error.	4. Calibrate or replace pressure gauges.
	5. Drain valve closed.	5. Open drain valve.

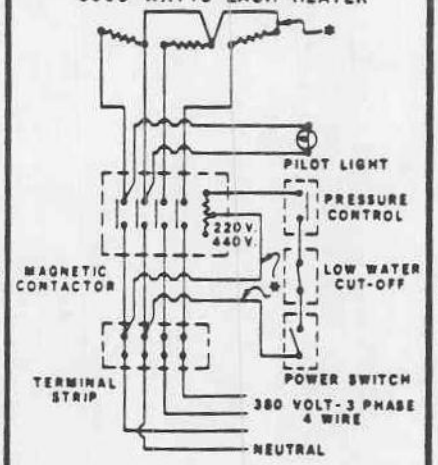
3000 WATTS EACH HEATER



FUSE EXTERNAL FOR 45 AMPS.

220 V. - SINGLE PHASE DIAGRAM A

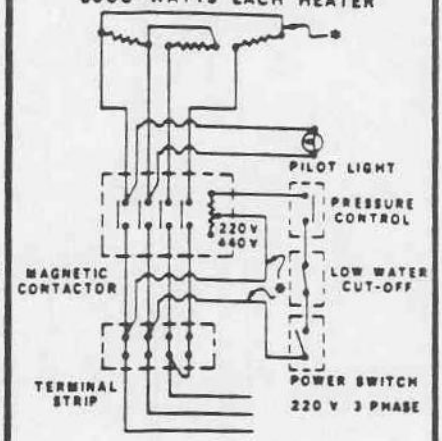
3000 WATTS EACH HEATER



FUSE EXTERNAL FOR 15 AMPS.

380 V. - 3 PHASE DIAGRAM B

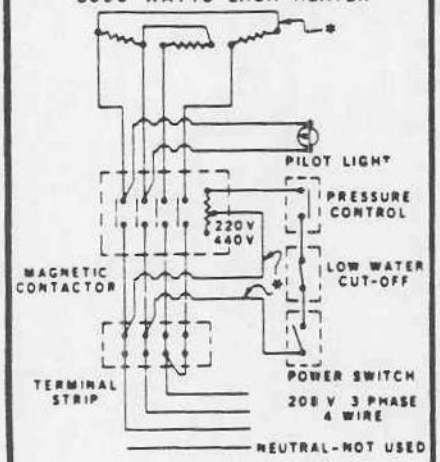
3000 WATTS EACH HEATER



FUSE EXTERNAL FOR 25 AMPS.

220V. - 3 PHASE DIAGRAM C

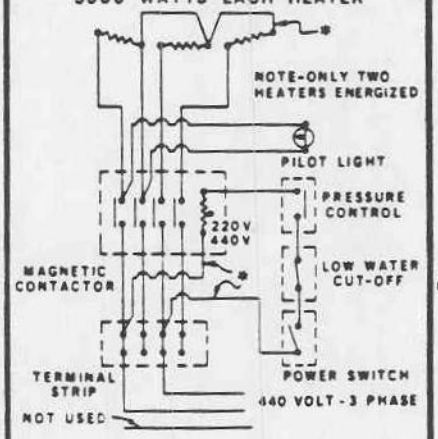
3000 WATTS EACH HEATER



FUSE EXTERNAL FOR 25 AMPS.

208 V. - 3 PHASE DIAGRAM D

3000 WATTS EACH HEATER

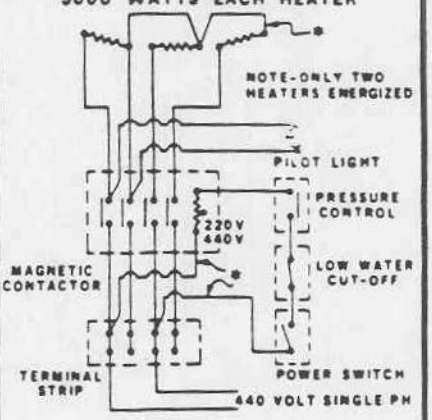


FUSE EXTERNAL FOR 15 AMPS.

NOTE-SINGLE PHASE ONLY USED ON THIS CIRCUIT CAUSING AN UNBALANCED LOAD

440 V. - 3 PHASE DIAGRAM E

3000 WATTS EACH HEATER



FUSE EXTERNAL FOR 15 AMPS

NOTE-UNIT OPERATES ON $\frac{2}{3}$ WATTAGE WITH ONLY 2 HEATERS ENERGIZED

440 V - SINGLE PHASE DIAGRAM F

*INDICATES CONNECTIONS WHICH MAY CHANGE WITH CHANGES IN POWER SUPPLY

CAUTION - A GOOD ELECTRICAL GROUND TO BE MADE TO UNIT BEFORE OPERATING.

WIRING DIAGRAMS

6530-00-926-2151